Beans (Snap)

ATLANTIC PROVINCES VEGETABLE CROPS GUIDE TO PEST MANAGEMENT 2002 - 2003

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Introduction

Snap Beans (green or wax) are a member of the Leguminosae (legume family). In the species *Phaseolus vulgaris*, are also dried beans which are harvested for baking beans. There are over 200 different types of beans originating in various parts of Central America which have been cultivated for over 7000 years. The plant may be a bush, a half runner or a pole bean. This crop is botanically described as an annual twining vine. Bean flowers are self pollinated. Snap bean cultivars differ from dry bean cultivars by having thicker walled pods. These vary in color with green, yellow and purple being the ones most commonly grown. Commercial cultivars are mostly determinate (non climbing). Flowers appear simultaneously and pods tend to mature together - an advantage for mechanical harvesting and where single heavy pickings are required for the fresh market. Some cultivars tend toward multiple branching and vining causing flowers and pods to develop over a period of time, allowing for several pickings. In 1894 the first stringless bean was introduced.

Snap Beans are adapted to both temperate and tropical areas where there is a greater frost free period than 50 days and soils are warm enough to allow seed germination. Beans are frosted at -1 to -2°. The minimum temperature for seed germination is 15°, with a maximum of 35° and an optimum range of 15 to 30°.

Seed rot is a problem at lower soil temperatures and is further aggravated by wet soils. Best crop growth occurs at 18 to 23° with a minimum of 10° and a maximum of 32°. Beans do well under warm conditions and date of maturity can be reliably estimated using degree days above 5°. Temperatures above 32° and below 10° will cause poor pod set. Snap beans are sensitive to soil moisture stress especially at the time of flowering.

Beans should be planted in well drained soils with good aeration and soil borne diseases have to be kept in check by good rotations. A range of soil textures are suitable to the crop but sandy loams are best suited for early crops and then loams for later production. The soil should be well supplied with organic matter. Organic soils are not recommended as they promote excessive vegetative growth. Avoid growing on steep slopes since the crop does not offer much protection against soil erosion.

Irrigation, if necessary or possible, is most effective at the time of bloom. Care has to be taken that disease is not aggravated by this water.

Snap Beans are available from late July to late September for both the fresh and processing markets. With tunnel house production this season could possibly be extended. Harvest is approximately two weeks after bloom.

An average yield for snap beans is 4400 kg per hectare. High yields vary from 6600 to 17,600 kg per hectare.

Snap Beans are an important crop in the Atlantic area mainly due to the processing industry. Relatively few beans are grown for fresh market use and most of this crop is picked by hand labor.

Nutrient Content: Good sources of Vitamin A, potassium and folate. Contains several other nutrients in small amounts. 250 mL (1 cup) contains 32 kilocalories.

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Seed Treatment - Chemical seed treatments should be used to protect seeds from maggots, wireworms and seed decay organisms. Seed treatment should not be done more than 3 months before sowing. See Guide to Pest Management and the seed treatment section.

Inoculation of seed with nitrogen fixing bacteria should be done on "new" fields with the use of a dust containing the proper rhizobium bacteria.

Beans should be handled gently as cracked seed coats and cotyledons decreases germination and seedling vigor.

Beans with a dark colored seed coat are generally more hardly and will germinate better under cold soil conditions.

Plant seed that is as disease free as possible as part of a full disease control program.

Seeding/planting - Seeding should be delayed until the cold weather is past, the soil has warmed (to 15°) and the danger of frost at emergence is past. Wet, cool weather will del germination, causing decay of seeds and increasing injury to seedlings by maggots and r rot organisms.

In heavier soils, seeds should be seeded no deeper than 2.5 cm, while in sandy soils up t cm is preferable. Sow as shallow as soil moisture levels permit. Planting in wet soil mus avoided because crusting of the soil and seed rot may occur reducing germination and vi

Typical Spacings and Plant Population Recommendations in Snap Beans

Desired Row Spacing (cm)	Plants Per Meter of Row	Approximate Seed Rate Per Hectare
90 to 95	20 to 26	80 kg
45, 50 & 60	17 to 22	100 kg
20 to 25	10	110 kg
15 to 18	6 to 8	165 kg

Closer row spacings will result in increased yields. In some fields gray mold and white r disease losses are greater with narrow rows. Wider row spacings are suggested for fresh market production for either mechanical harvesters or hand pick. Narrow rows should be used for processing beans when proper harvesters are available. No till seeding is being tested.

Pole beans can be grown on a nylon mesh fence in small commercial fields for fresh ma (also in tunnel houses).

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Cultivation - Preplanting soil preparation and adequate herbicides are recommended so cultivation of the bean crop is not necessary. Bean roots, although penetrating the soil fc to 1 meters, are located mainly in the top 20 cm of soil. If cultivation is necessary it shou be early in the life of the crop and as shallow as possible. It should cease after bloom an never be done when the leaves are wet, because of the danger of disease spread.

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ALL ADDITIONS OF LIME AND FERTILIZER OR MANURES SHOULD BE BASE ON RECOMMENDATIONS FROM A SOIL TEST.

Beans require a highly fertile soil but do not, however, respond rapidly to direct soil applications of fertilizer. Heavy applications of manure are not recommended for beans there may be excessive vegetative growth and a higher risk of seed corn maggot injury.

Lime - Lime should be applied to maintain the soil pH in the range of 6.5 to 6.8.

Nitrogen - Snap beans have a low requirement for nitrogen since it is a legume crop. If phosphorus and potash levels are high no nitrogen may be required. Over applications of nitrogen reduces concentration of maturity and causes excess plant growth. Side dressing of nitrogen is only recommended following heavy rains if foliage suggests a nitrogen deficiency. Extra nitrogen may help alleviate yield reductions caused by bean root rots.

Generally apply 30 kg per hectare by banding at the time of planting on low N potential soils (sandy and low organic matter).

Phosphorus - Banded phosphorus is necessary at the time of seeding, even at high phosphorus levels. Use at least 50 kg per hectare

Potash - This element is best broadcast and incorporated into the soil prior to planting either as muriate of potash or manure. Banded potash can reduce yields.

Sulfur - Application is suggested on sandy soils with low organic matter which have been intensively cropped (use gypsum).

Magnesium - Beans are sensitive to deficiency of magnesium so a fertilizer containing MgO should be used where magnesium deficiency is suspected. Use dolomitic limestone when required.

Micronutrients - Beans are sensitive to excessive residue of *boron* especially on soils with a low pH (under 6). *Zinc* deficiencies may be a problem as it has been reported on other crops in the Atlantic area. Watch fields which are intensively cropped with low organic matter and not receiving applications of manure. *Manganese* deficiency is a problem when the pH is over 6.8. One or two foliar sprays of Magnesium Sulphate may be required to correct this problem. Use manganese sulphate at 3 kg of product in 1000 L of water (also use a spreader sticker).

Application Method - All fertilizer should be broadcast and disked in, or preferably, the nitrogen and phosphorus banded 5 cm below and 5 to 7 cm to the side of the side of the seed row.

Pests and Pest Control ▲ to Top

Weeds

There are several effective preplant incorporated, preemergence and postemergence herbicides available for use on beans. Preemergence treatments provide good control of annual broadleaf weeds. When a heavy annual grass infestation is anticipated a preplant incorporated treatment should also be used. Postemergence treatments are available for both grass and broadleaf weed control. The timing of postemergence treatments is critical for the control of some species and control may be poor if applications are not properly timed.

Care must be taken to avoid fields where residual herbicides from previous years persist in the soil as crop injury may occur.

No till seeding is being tested using herbicides that are currently registered.

Diseases

Anthracnose (fungus) and Bacterial Blights

Characteristics: Signs of anthracnose usually appear on the lower leaf surface along veins which show a brick red to purplish red discoloration. Lesions may also appear on stems causing them to break. On the pods, the disease appears as small brown specks or rusty brown spots. As the spots enlarge, their centers become sunken and turn brown. Under humid conditions, masses of pinkish spores appear on the lesions. Seeds obtained from heavily infected pods show brown to light chocolate colored spots on the seed coat.

Symptoms of bacterial blight appear on leaves as water-soaked or pale green spots or groups of spots surrounded by a narrow or wide greenish yellow halo. The spots may turn brown and dry and leaves may shrivel and die. Water soaked spots may appear on pods and combine to form blotches of reddish brown discoloration. Bacterial blight becomes progressively more severe as beans approach maturity.

Control: The causal organisms over-winter in seed and plant debris. Do not use home-grown seed. Purchase disease-free snap bean seed. Practice a 3-year crop rotation. Do not cultivate or harvest when plants are wet. Applications of fixed copper will reduce the spread of bacterial blights. Rogue and destroy affected plants. Do not spread bean refuse or manure containing bean refuse on land intended for beans in the next three years.

Sclerotinia White Mold and Gray Mold (fungi)

Characteristics: Gray and white cottony mold which causes a watery soft rot on plants, bean pods and stems, in which hard black bodies are produced. This disease spreads rapidly after harvest. Infection starts on the flowers and spreads from there to the other plant parts.

Control: Plant on well drained soil not recently used for soybeans, canola, beans, lettuce, peas, tomatoes, carrots, parsnips, cucumbers, celery or cabbage. Practice a 5-year rotation. Serious losses result when susceptible crops are grown for several consecutive years. Do not apply excess irrigation. Cultivate and pick when plants are dry. Avoid fields with a history of *Sclerotinia*. Plow plant refuse down immediately after harvest to prevent development of Sclerotia to higher levels. All sprays must penetrate crop canopy and contact blossom petals. Applications of fungicides must be applied during bloom. Use best equipment available. Do not use manure infected with white mold Sclerotia.

Root Rot (fungus)

Characteristics: The taproot shows various surface discolorations of reddish brown or dark brown and smaller roots may be rotted away.

Control: Root rot is caused by a complex of several soil borne organisms. It is present in every soil and nearly all plants have some degree of root rot. In seriously infected fields, long rotations of 6 years or more are necessary. Bean refuse should always be placed in areas where beans will not be grown. Any bean refuse left on the field should be turned under deeply by fall plowing. Plant only on well drained, well fertilized soils.

Common Mosaic and Yellow Mosaic (viruses)

Characteristics: Plants infected with mosaic show mottling and mosaic patterns in the leaves which appear as irregular light green areas mixed with dark green patches. The darker areas grow faster resulting in puckered leaves. Plants may also wilt and show dieback of tips and branches. Infected plants are dwarfed and produce only a few small pods.

Control: These seed-borne viruses are spread in the field by aphids. Grow mosaic resistant cultivars. Avoid planting beans next to sweet clover, red clover and gladioli from which aphids may spread mosaic.

Bronzing

Characteristics: This is a physiological disorder caused by high levels of atmospheric ozone associated with air pollution. It occurs following the initiation of flowering and after the older leaves become fully mature. Pods are affected as well as the upper surface of the leaves.

Control: Some cultivars are more resistant.

Insects

Seed Corn Maggot

Characteristics: The adult seed corn maggot fly deposits her eggs in moist soil where there is an abundance of decaying vegetable matter. The larvae (maggot) of the seed corn maggot is 5 mm long and pale in colour. The damage is caused by the maggot burrowing into the seed, often destroying the embryo. Damaged seed will either not germinate or produce a deformed plant. Damage is most severe in cool wet weather when germination is slow.

Control: Plant seeds as shallow as needed in a well prepared seedbed. Early germination is necessary to get good plant stands and prevent injury. Later planted crops are not as susceptible to this pest. Avoid planting susceptible crops in fields recently manured. Chemical seed treatment is essential. Good weather conditions are necessary to completely control the pest.

Two-Spotted Spider Mite

Characteristics: An occasional pest but when it does occur can be serious. Leaves become speckled and then turn bronzed or brown. A fine webbing is produced on the underside of the leaves. The mites are microscopic in size. Usually this pest only becomes a problem under very hot dry weather conditions.

Control: A predator mite may help control the two-spotted spider mites but may not control a severe outbreak successfully.

European Corn Borer

Characteristics: European Corn Borer larvae over- winter in corn stubble. By July they become moths that fly mostly at night. A single female lays eggs in small groups of 20 to 40 on the underside of host plant leaves. The larvae hatch within a week and enter the bean pods. Several pods will be damaged by a single larvae before it stops feeding. This pest has not become a serious problem in snap beans but damage to baking bean seeds is evident after harvest.

Control: Plow down corn stubble in the fall. Avoid planting beans after corn in rotation or adjacent to corn in the crop year.

Wireworms

Characteristics: Early in the spring, adult wireworms (click beetles) lay their eggs around grass roots. The larvae hatch in about a week and, depending on the species, will live for 1 to 5 years in the ground feeding on roots and seeds. Wireworms require 3 or more years to complete their life cycle. Wireworms of all sizes and ages are present in the soil throughout the year as there is always an overlapping of generations. The wireworms, or larvae, are yellow, white or darker shades of brown. Fully developed larvae may be 1.2 to 4 cm long and have a hard, smooth surface. When a larva is mature, it pupates in the fall. It then becomes an adult beetle and waits until spring to emerge. Wireworms are often numerous in land that has been in sod for several years. They are also more abundant in heavy poorly drained soil.

Wireworms are sometimes confused with millipedes. Millipedes have numerous pairs of legs and coil up when disturbed, while wireworms have three pairs of legs near the front of the body and do not coil up.

Control: Plant treated seed and avoid planting crops highly susceptible to wireworms in a field that has been recently in sod. See appendix III in the Guide to Pest Management for Vegetable Crops.

SPECIFIC CHEMICAL CONTROLS MAY BE FOUND IN THE "GUIDE TO PEST MANAGEMENT" FOR VEGETABLE CROPS.

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Snap beans are currently harvested by hand for the fresh market or by mechanical harvesters (ie. multi-D type harvesters) for the processing market.

The following is an example of processing grades:
Grade #1 Green or Wax Snap beans, sieve sizes of 1, 2, 3 & 4.
Grade #2 Green or Wax Snap beans, sieve sizes of 5+.

Fresh market beans should be free of white mold as problems may develop during storage and transport of the crop. These beans must be quickly moved from the field and cooled. Hydrocooling is the preferable method because cooling is rapid and the free moisture helps to prevent wilting or shrivelling. Vacuum cooling or forced-air cooling can also be used.

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Snap beans can be held 8 to 10 days if necessary at a temperature of 4 to 7° and a relative humidity of 95% or above. Chilling injury occurs at temperatures below 4° and russeting will develop upon removal from storage. Free moisture on the beans should be avoided if beans are held above 7° to minimize decay development.

Bibliography ▲ to Top

(See also General References)

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PEST	PESTICIDE (Formulation)	RATE Product	DAYS TO HARVEST	REMARKS
Weeds ▲ to Top				
Preplant Perennial Weeds including quackgrass	ROUNDUP 356 Sn	2.5 to 7.0 L/ha	-	Apply in the fall or spring prior to planting. Annual weed control programs will be necessary to control weeds germinating after planting. For quackgrass control apply to actively growing quackgrass when at least 4 new leaves are present. The low rate (2.5 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control. The low rate of Roundup should
	TOUCHDOWN 480	2.5 to 7.0 L/ha	-	
	GLYFOS	2.5 to 7.0 L/ha	-	

	ROUNDUP TRANSORB	2.5 to 7.0 L/ha	-	be applied in 50 to 100 L/ha water. If higher water volumes are used add a suitable surfactant. Wait 72 hours before plowing under. Best control of quackgrass is obtained when these herbicides are applied in the fall.
Preplant Incorporated Treatments Germinating annual grasses and some broadleaf weeds	EPTAM 800 EC	4.25 to 5.5. L/ha	-	Must be applied to a dry clod-free soil surface and incorporated within 10 minutes. Use in conjunction with preemergence or postemergence herbicide for control of broadleaf weeds.
	TREFLAN 480 EC	1.2 to 2.3 L/ha	-	Incorporate within 8 hours of application following label instructions. Ragweed and mustards are not controlled. Corn or cereal grains may be injured when planted in fields treated with trifluralin the previous year. Use in conjunction with pre-emergence or postemergence herbicides for control of broadleaf weeds.
	RIVAL 60 DF	1.0 to 1.9 kg/ha	-	
	DUAL II MAGNUM	1.15 to 1.75 L/ha	-	Do not use on very sandy soils or those high in organic matter. Use in conjunction with pre- and postemergence herbicide for broadleaf weed control.
Preemergence Treatments Germinating broadleaf weeds	AFESIN 200 EC	3.75 to 7.0 L/ha	-	Do not use on coarse sandy soil or on soil with less than 3% organic matter. Shallowly planted crops may be injured if heavy rains follow application. Partial grass control.
	PATORAN FL 400 SU	2.8 to 3.44 L/ha	-	Do not exceed the low rate on snapbeans. Use the lower rate on sandy soils with less than 2% organic matter. Shallowly planted crops may be injured if heavy rains follow application. Partial grass control.
	PATORAN 50 WP	2.25 to 2.75 kg/ha	-	
Postemergence Treatments Broadleaf Weeds	BASAGRAN 480 Sn plus ASSIST oil conc.	1.75 to 2.25 L/ha plus 2 L/ha	-	Apply in 200 to 400 L water per hectare when beans are in the unifoliate to 4th trifoliate leaf stage and weeds are growing actively. Split applications may be necessary for Canada thistle control. Not residual.
Emerged Quackgrass	POAST Ultra plus MERGE or ASSIST	1.6 L/ha 2 L/ha	80	Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 220 L of water/ha.
Annual Grasses	HOE-GRASS 284 EC	3.5 L/ha	-	Apply when annual grasses are in 1 to 4 leaf stage. Controls volunteer corn but not volunteer cereals, quackgrass or crabgrass. Do no tank mix with other herbicides.
	POAST Ultra plus ASSIST or MERGE	0.32 to 0.47 L/ha 2 L/ha or 1 L/ha	60	Treat at 1 to 6 leaf stage of annual grasses. Use higher rate on volunteer cereals.

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Seedcorn maggot				See "Seed Treatment"
Twospotted spider mite	CYGON 480 EC	0.7 to 1.0 L/ha	7	Most serious in dry years. Do not graze or feed crop refuse to livestock.
	DIMETHOATE 480EC	0.7 to 1.0 L/ha	7	
	LAGON 480 EC	0.7 to 1.0 L/ha	7	
	KELTHANE 35 WP	1.1 to 1.75 kg/ha	7	Use low rate for small plants. Use high rate for larger plants.
European corn borer	SEVIN 50 WP	4.5 kg/ha	3	An occasional pest. Control requires carefully timed repeated applications. Apply in sufficient water to give complete coverage. Monitor moths using pheromone traps.
	SEVIN 85 WP	2.65 kg/ha	3	
	SEVIN XLR Plus	5.25 L/ha	5	
	GUTHION 240 SC	2.25 L/ha	3	
	LANNATE L	2.3 L/ha	7	Worker re-entry period 24 hours.

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Pythium and *Phytophthora* root rot	RIDOMIL Gold 480 EC	0.3 L/ha	at planting	Apply at the rate of 2.3 ml of product/100 m of row based on a 20 cm spray band and 76 cm row spacing. This is equivalent to 0.3 L per treated hectare. See label for further details.
Sclerotinia white mold *Botrytis* pod rot	BENLATE 50 WP	1.75 to 2.25 kg/ha	14	Where white mold has been a serious problem in the past, apply Benlate 50 WP 1.75 kg/ha when 20-30% of the plants have one open blossom followed by Rovral 50 WP 1.5 kg/ha, 5 days later. In fields without a history of severe disease, apply Benlate 50 WP, 1.75 kg/ha or Rovral 50 WP 1.5 kg/ha when 50% of the plants first have one open blossom. Effective control can only be achieved by using drop nozzles and high pressure so that spray contacts blossoms. Apply Ronilan at early bloom and a second application 7 days later at full bloom. Use higher rate under extremely favourable disease conditions. When conditions are dry before and during bloom no fungicide is required.
	ROVRAL 50 WDG	1.5 kg/ha	not after bloom	
	RONILAN 50 DF	1.0 to 1.5 kg/ha	20	
	RONILAN 50 EG	1.0 to 1.5 kg/ha	14	